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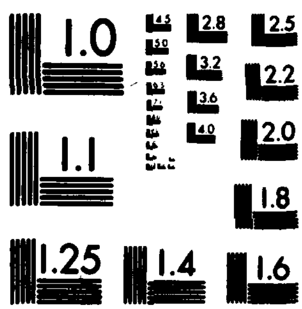

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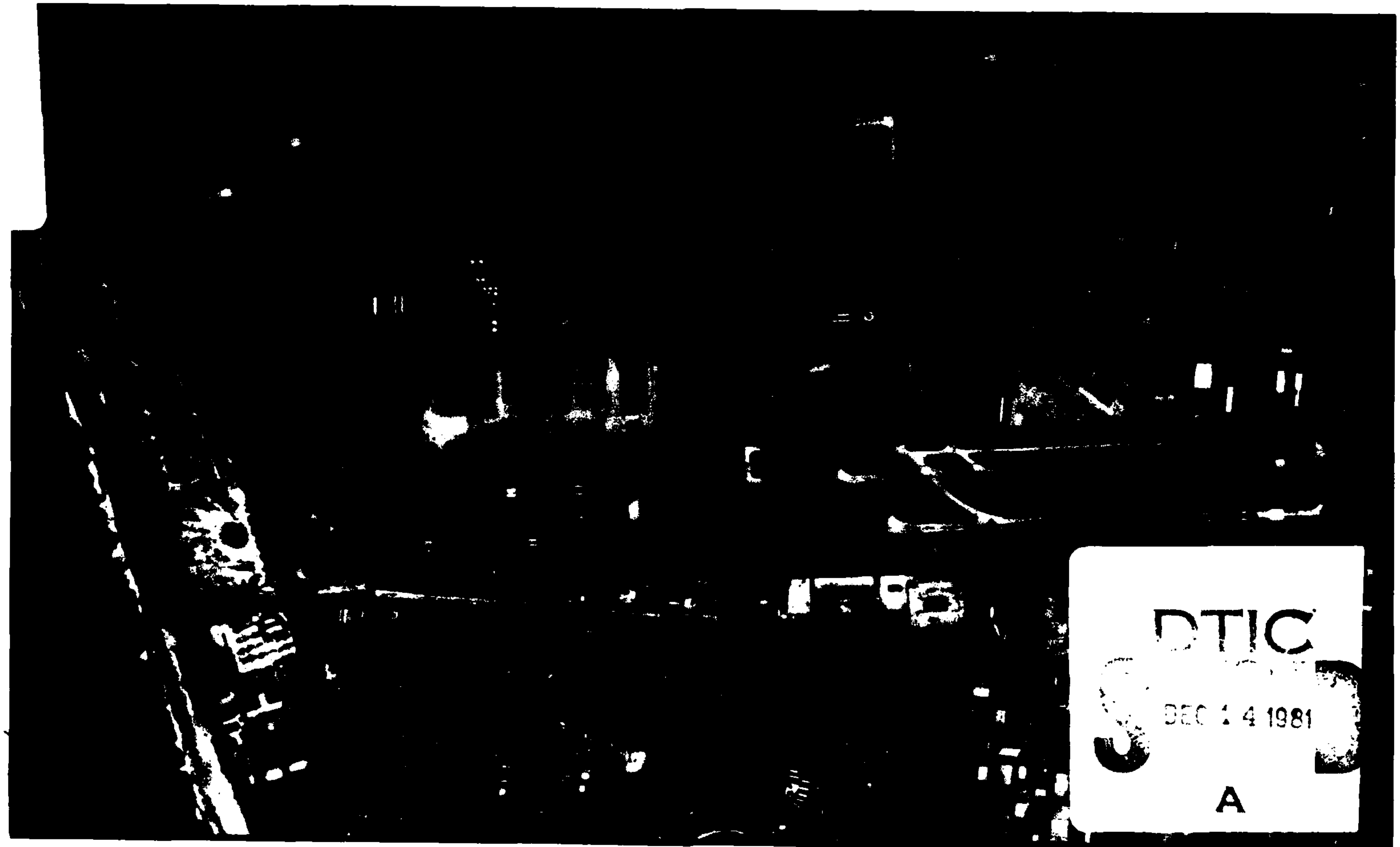
Task Force Delay Study

Los Angeles International Airport Improvement Program

Prepared through joint effort of Department of Transportation Federal Aviation Administration Los Angeles Department of Airports Air Transport Association Airlines Serving Los Angeles



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16. Abstract

This report presents the results of a detailed analysis of the Los Angeles International Airport. The analysis was conducted by the Los Angeles Airport Improvement Working Group which had representatives from the airport sponsor, the Air Transport Association, the airlines serving Los Angeles, and the Federal Aviation Administration. The purpose of the analysis was to determine the causes of delay and the potential delay reduction benefits of recommended improvements. The effort was part of the Airport Improvement Program.

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Introduction

1.1 Background

During the last ten years airport/runway capacity has been impacted by a number of constraints. For example, sound abatement resulting in operational restrictions, the increased separation standards mandated by heavy jet wake vortices and changes in air traffic demand have all contributed to decreasing airport capacity and increasing aircraft delay. The Federal Aviation Administration (FAA) and the Air Transport Association (ATA) have been concerned about capacity and delay at the nation's major airports. Consequently, the Los Angeles Task Force Study Group was formed in 1975 to analyze all aspects of airport capacity, review planned improvements, and recommend future improvements and strategies.

1.2 Objectives

Considering the escalating delays which continue to occur at Los Angeles International Airport and the increased energy cost of each aircraft operation, the Task Force Study Group agreed on the following objectives to guide an in-depth analysis of current and future operational requirements:

a. To identify the causes of delay and determine the effect of various airport design improvements on delay at the airport.

b. To identify the delay reduction benefits of alternative procedures and the hardware improvement options for near-term and far-term implementation.

c. To determine the relationships between air traffic demand and delay in the present and future time periods as an aid to establishing acceptable air traffic movement levels.

d. To obtain new insight into the interdependence of terminal facilities, airport design, procedures, fleet mix and air traffic demand.

1.3 Scope

All analyses focused on means for increasing facility operating efficiency, and reducing delays through procedural adjustment, airport development actions, or airport use/operating policy changes. While environmental implications were recognized in the development of some recommendations, the precise assessment of environmental impact was considered outside the scope of this Task Force Study Group and was not addressed.

The Task Force identified the major sources of aircraft delay (summarized in Table 1-1 and discussed in Chapter 3). After evaluating

some 20 improvements recommended by the various participants in the program, the Task Force elected to determine the delay reduction benefits of 9 near-term improvements. (Summarized in Table 1-2 and discussed in Chapter 4)

Table 1-1: Major Sources of Current Aircraft Delay:

a. Noise abatement runway restriction of heavy aircraft departures on Runway 24L.

b. Disproportionate distribution of aircraft traffic between the north and south runway complexes due to Sepulveda overpass weight restrictions on the south runways.

c. Noise abatement procedures on Runway 24R.

Table 1-2: Delay Reduction Improvements

a. High-speed taxiway off runway 25L to the south.

b. Strengthening of the Sepulveda Tunnel.

c. Departure by-pass taxiway around runway 24L to runway 24R.

d. Temporary holding areas.

e. Parking for 24 aircraft at the west end of the airport.

f. Terminal expansion including Terminal 1 and the West Terminal.

g. High-speed taxiway off runway 7L to the north.

h. High-speed taxiway off runway 6R to taxiway 47.

i. Departure by-pass taxiway around runway 7L to runway 7R.

Actual and forecasted air traffic demands were prepared for the 1978, 1982, and 1987 time periods. All possible runway configurations under both visual and instrument meteorological conditions were analyzed.

The experiments produced hourly results which formed the basis for calculation of airport delays and associated costs. The estimates of potential annual savings from proposed airport improvements are listed in detail in Chapter 4 of this document.

The September 1977 Interim Report prepared for this program included discussion on ground access constraints and possible programs to mitigate these constraints. Further analysis of ground access is beyond the scope of this report.

1.4 Methodology

This study was conducted using a fast-time simulation model that describes the significant movements performed by aircraft on the airfield and reflects the effects of delay in the adjacent airspace. The model was validated against real world flow-rate and delay data at Chicago's O'Hare International Airport. It was then calibrated against field-data collected at Los Angeles International Airport to ensure the model was site-specific. The data resulting from model experiments simulating airfield/operational improvements were then compared with data from control or baseline experiments, and the potential reductions in delay were assessed.

2.0 System Description

Los Angeles International Airport (LAX) is located approximately 13 miles southwest of the Los Angeles central business district. The airport lies within Los Angeles County on approximately 3,500 acres of land. The airport's main access lies east of the airport boundary near the San Diego Interstate Freeway (405). This freeway system provides access to the airport from nearby population centers.

The analysis encompassed a system composed of the Los Angeles terminal airspace, the airfield, and the apron/gate facilities. The components of the total system include the Los Angeles approach control airspace, approach areas, runways, exits, the apron area, and the aircraft gate positions. The purpose of this section is to describe briefly the physical properties of the following components:

- Existing Airspace Structure
- Existing Airfield Facilities
- Existing Apron/Gate Facilities

These system elements are discussed in the following paragraphs.

2.1 Existing Airspace Structure

The purpose of the following discussion is to provide a basic inventory, review and preliminary analysis of the en route and terminal airspace system associated with Los Angeles International Airport.

2.1.1 En Route Responsibility of the Los Angeles Air Route Traffic Control Center (ARTCC)

The Los Angeles ARTCC controls all the IFR air traffic arriving and departing the Los Angeles Basin area. Traffic for Los Angeles and satellite airports is handled by the ARTCC before control is transferred to Los Angeles Terminal Radar Approach Control (TRACON). Aircraft overflying the Los Angeles terminal airspace are routed over Los Angeles Airport for north/south traffic and north of the airport for east/west traffic.

Of primary concern are the transition sectors through which aircraft arriving Los Angeles are transitioned (in altitude) from the en route portion (about 18,000') to the terminal portion (9,000') of their flight. Associated with each of these sectors is an approach fix (clearance limit) at which control of inbound aircraft is generally transferred ("handed-off") from Center to Approach Control. Air traffic initially generated and remaining wholly within the Los Angeles basin, the area within a 60 mile radius of the Los Angeles International Airport, is normally controlled by the various Terminal Radar Approach Control (TRACON) facilities: Burbank to the north, Ontario to the east, Coast to the southeast, and Pt. Mugu Radar Air Traffic Control Facility (RATCF) to the west. Transition sectors, with associated primary approach fixes, are the east-southeast (DOWNEY) and west-north (STADIUM) arrival sectors.

2.1.2 Terminal Area Responsibility of the Los Angeles TRACON

After handoff by the Los Angeles ARTCC transition sector controller, the arriving flights are merged into a single stream before the turn to final approach for Los Angeles. For the parallel runway operations shown in Exhibits 2-3, turns onto the final approach are separated by 1,000' in altitude until established on the respective ILS localizer/final approach course.

Los Angeles arrivals are handled by two approach controllers who split all Los Angeles arrival traffic based on the primary direction of runway operation. Each of the approach controllers vector traffic to a separate runway and is responsible for merging the aircraft from appropriate approach fixes with the spacing requested by the Control Tower.

In the same manner, the spacing is adjusted to accommodate departures, as required. Departures are handled by giving the flights a vector heading shortly after takeoff. These headings, in general, are designed to allow the departing flight to proceed to the point of handoff to the en route controller.

Because of the high level of traffic to and from Los Angeles, a Group I Terminal Control Area (TCA) overlies Los Angeles International Airport. This controlled airspace is shown in Exhibit 2-1. Also depicted in the exhibit are four general aviation airports located within the Los Angeles terminal area airspace. Of the four airports, presently three have instrument approach capability. The terminal area is dominated by operations at the Los Angeles Terminal. ATC procedures are designed to facilitate the movement of flights into and out of LAX with maximum efficiency and also accommodate traffic serving these satellite airports.

2.2 Existing Airfield Facilities

The airfield area includes a system of runways and taxiways as shown in Exhibit 2-4. The airfield consists of two sets of parallel runways running east and west. The south set of runways (25 complex) cannot be used by wide body aircraft which weigh more than 300,000 lbs due to the Sepulveda Tunnel weight restriction. These aircraft must use the north runways (24 complex) for arrival and departure.

At present all runways have full ILS systems. Runway 24R is the only CAT II* ILS runway and the only runway with centerline and touchdown zone lights. A summary of pertinent information on existing runway characteristics, instrumentation and lighting is shown in Exhibit 2-5.

*This will be upgraded to CAT IIIa in 1981.

Exhibit 2-1
Los Angeles Terminal Control Area (Group 1)

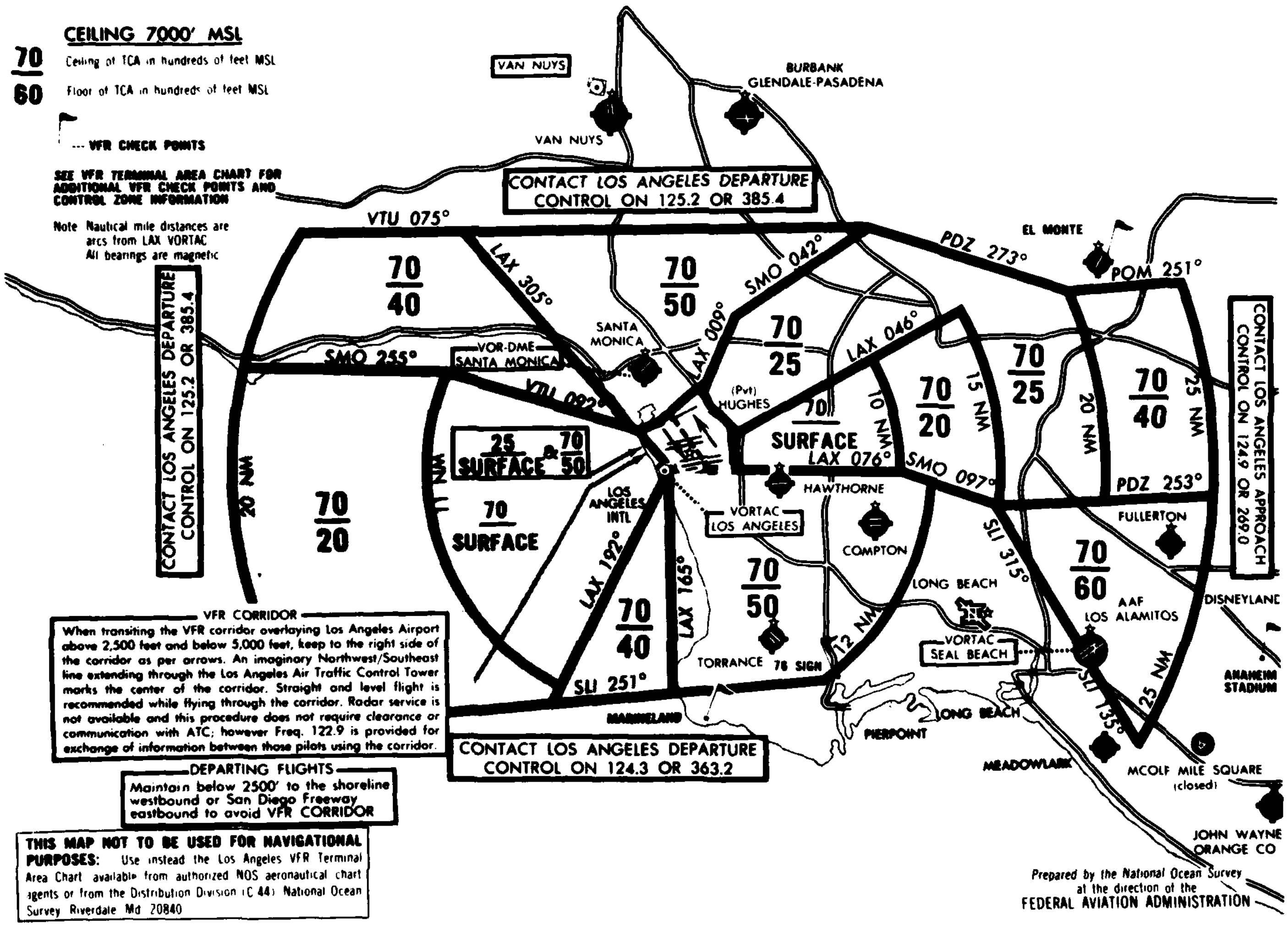

Exhibit 2-2
Los Angeles ARTCC

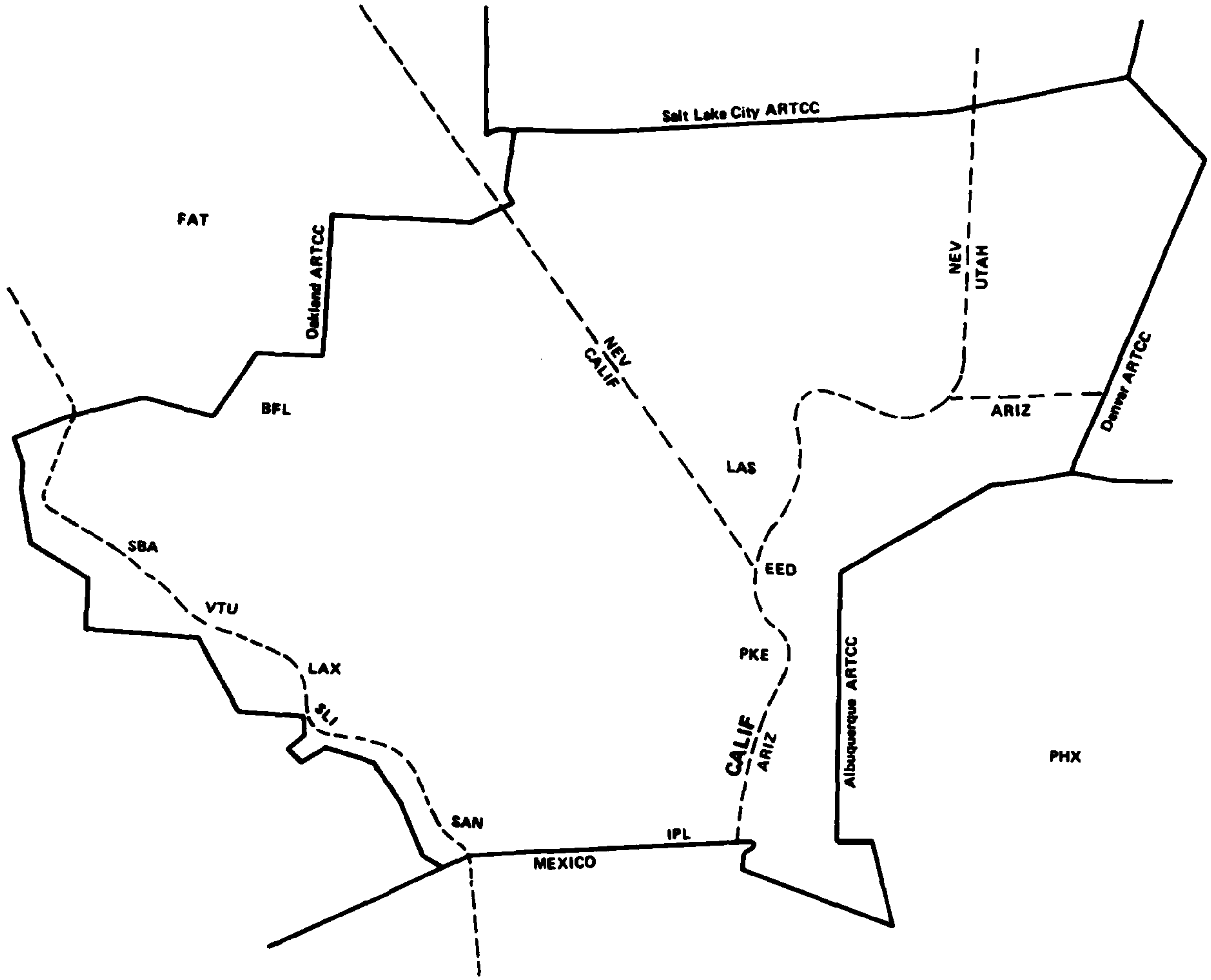

Exhibit 2-3a
Los Angeles TCA Major Arrival/Departure Routes West Traffic

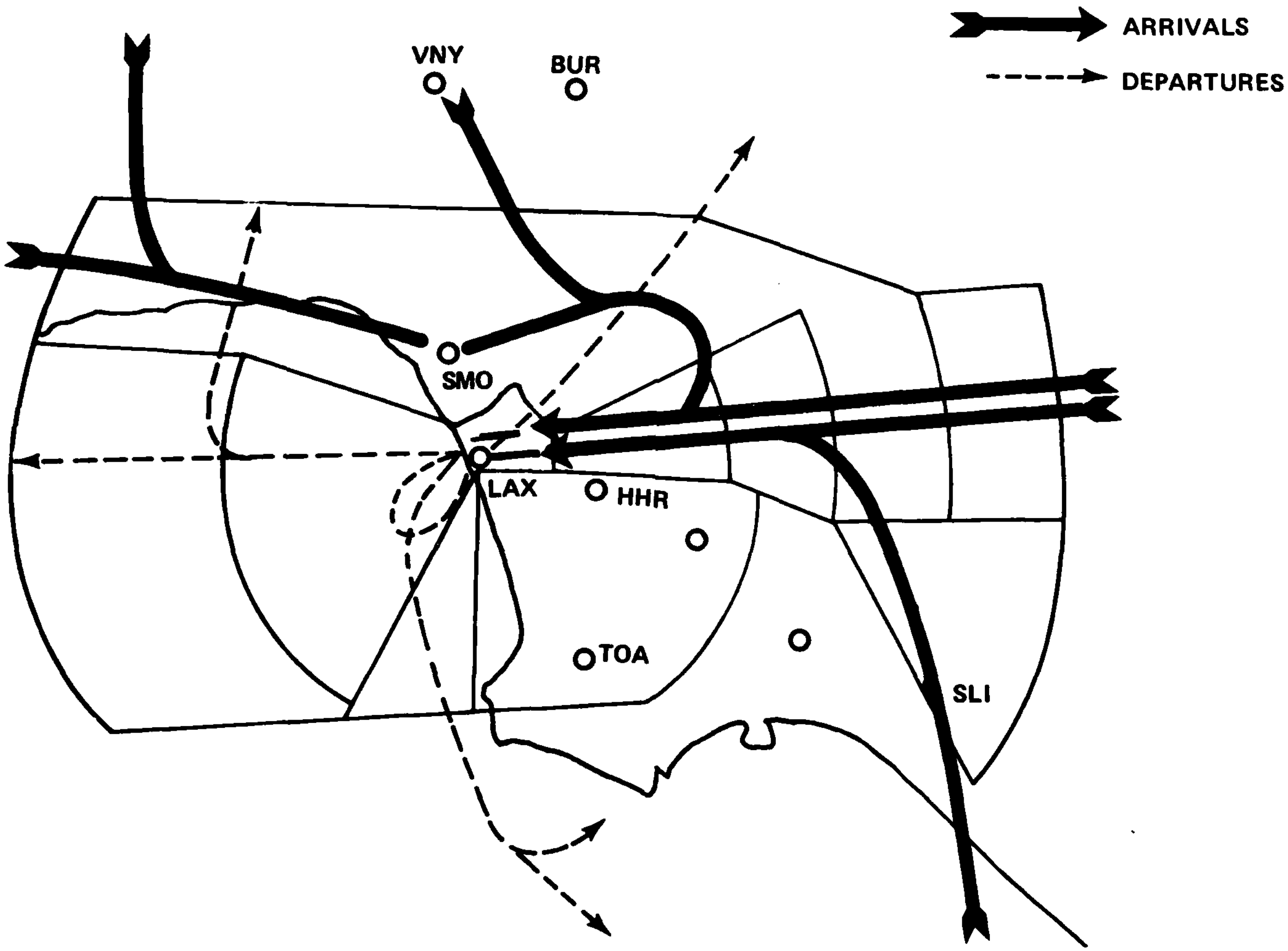

Exhibit 2-3b
Los Angeles TCA Major Arrival/Departure Routes East Traffic

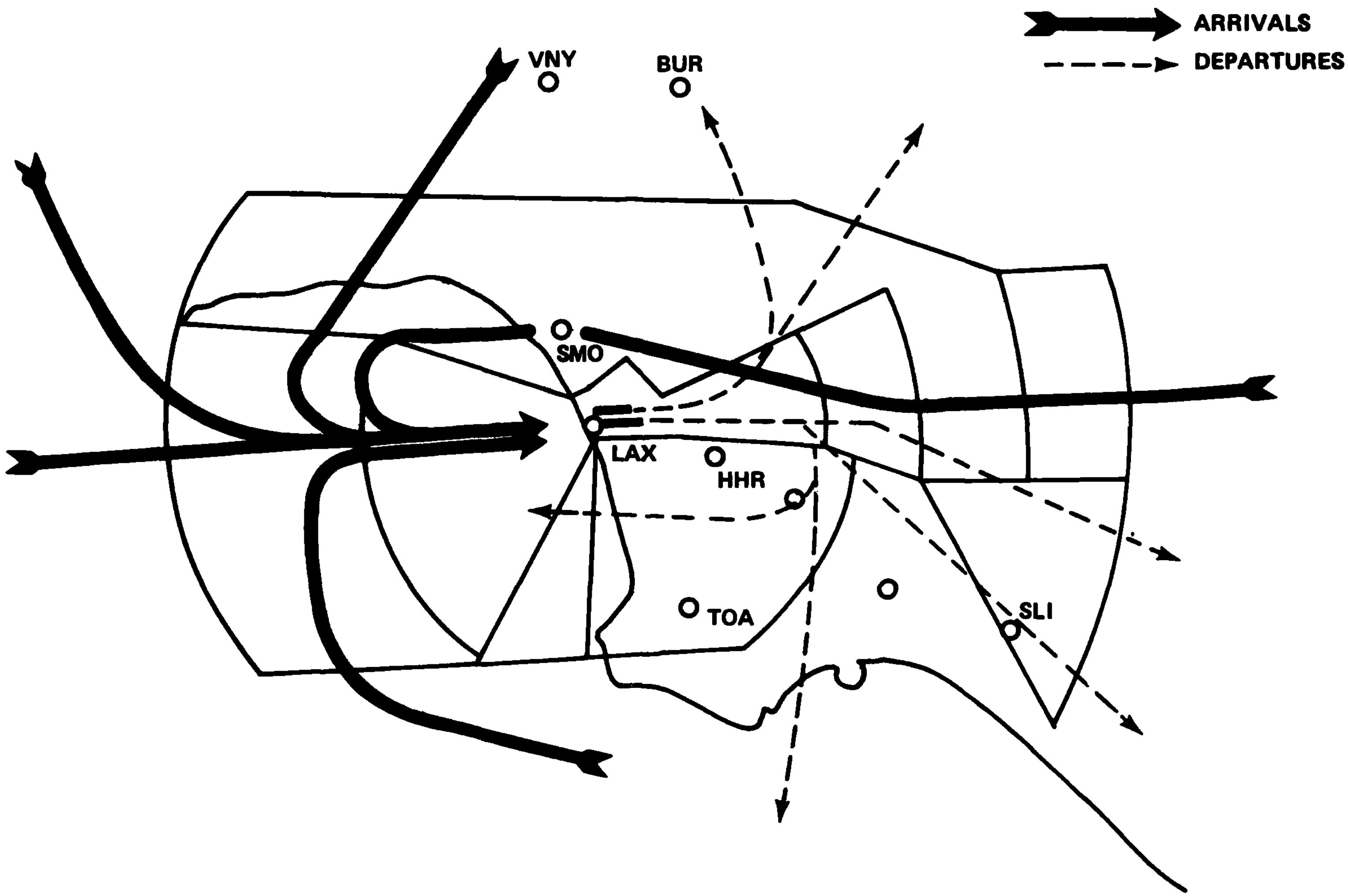

Exhibit 2-4

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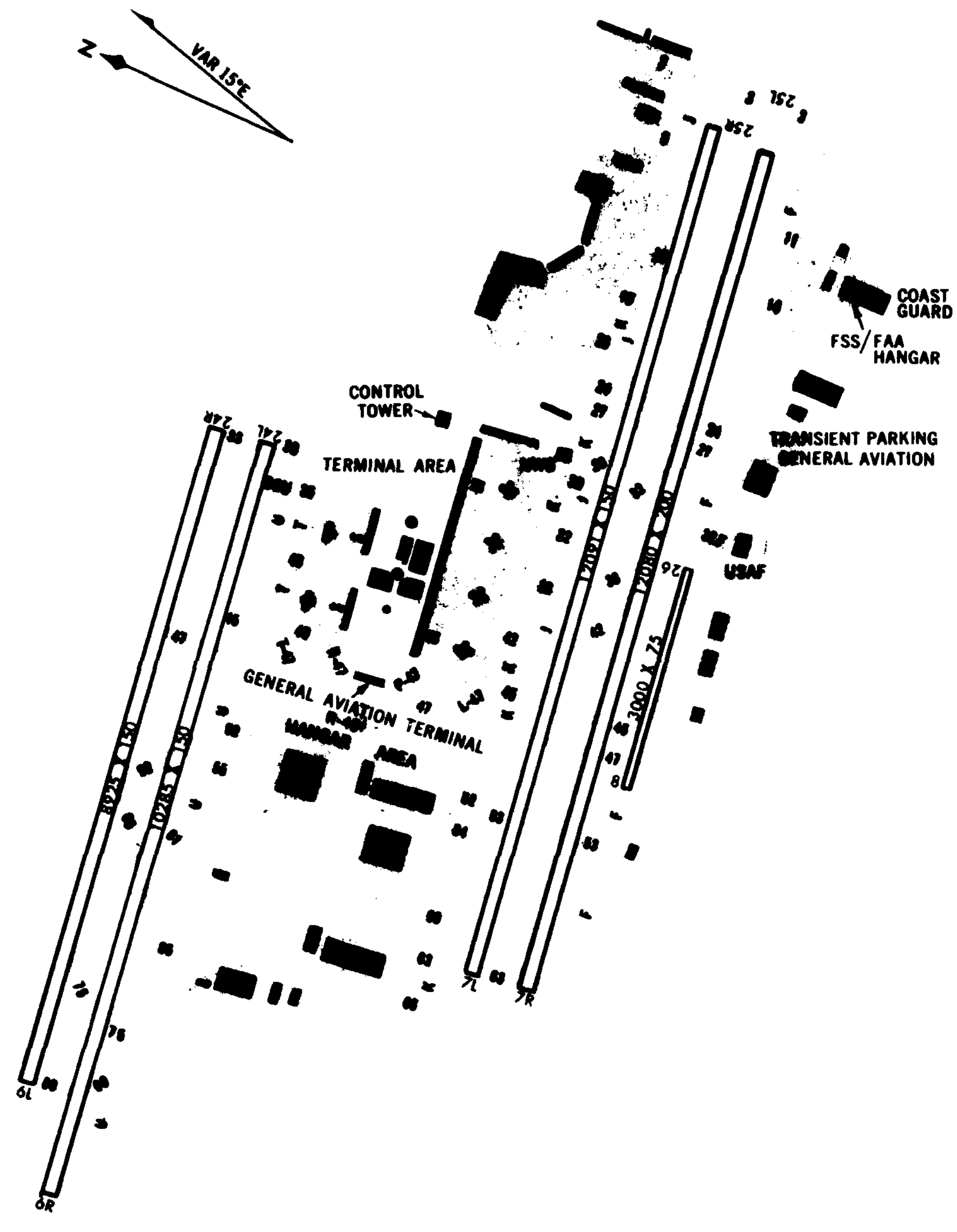
AIRPORT TAXI CHART LOS ANGELES INTERNATIONAL AIRPORT
AL-237 (FAA) LOS ANGELES, CALIFORNIA



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AIRPORT TAXI CHART LOS ANGELES, CALIFORNIA
LOS ANGELES INTERNATIONAL AIRPORT

Exhibit 2-5
Existing Airfield Characteristics

RUNWAYS	24R/6L	24L/6R	25R/7L	25L/7R
LENGTH (feet)	8925	10285	12091	12000
WIDTH (feet)	150	150	150	200
ILS Category	II / I	I / I	I / I	I / I*
	TERMINAL NAVAIDS			
GS	X X	X X	X X	X X
LOC	X X	X X	X X	X X
OM	X	X	X	X
MM	X X	X X	X X	X X
IM	X	X		*
ALSF/MALSR	X X	X X	X X	X X
RVR	X	X	X	X
VASI	X	X	X	X
	RUNWAY LIGHTS			
HIRL	X X	X X	X X	X X
MIRL				
CENTERLINE	X X			*
TDZ	X			*

*Runway 25L is scheduled for ILS CAT II in 1983 with IM, Centerline lights and TDZ lights.

3.0 Current System Performance

Airfield capacity is the maximum number of aircraft operations (landings or takeoffs) that can be processed in a given time under specific conditions of:

- Airspace Constraints
- Ceiling and Visability Conditions
- Runway/Taxiway Layout and Use
- Aircraft Mix
- Arrival/Departure Percentage

Capacity estimates were obtained using the FAA Capacity Model with inputs established by the Los Angeles Task Force. Using this analytical approach, the full capacity of Los Angeles International if there were no environmental restrictions on the North runway complex is 147 operations per hour for visual approaches and 128 operations per hour under instrument conditions.

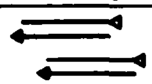
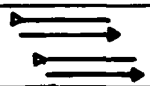
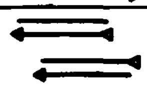
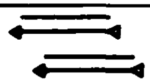
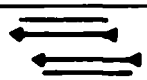
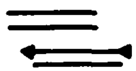
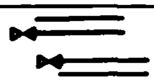
For the purpose of evaluating the effects of the improvements suggested by the Task Force, runway capacities were computed based on the current operational restrictions on the use of Runway 24L and 24R. VFR runway capacity is 114 operations per hour and IFR runway capacity is 94 operations per hour. Furthermore, runway capacity drops to 34 operations per hour in CAT II conditions.

Exhibit 3-1 presents the engineered performance standards (EPS) for Los Angeles International. The EPS is somewhat different than the capacity estimates used in the simulation model. This is due to the fact that Los Angeles International operates under strict metering procedures and IFR separation minimums in all categories of weather. This is due to noise abatement and en-route flow control procedures. These minor differences between EPS and analytical capacity estimates should have no impact on the conclusions contained in this report. Several other factors limit the full utilization of airfield capacity. These operational restrictions contribute directly to aircraft delays.

- The Sepulveda Boulevard overpass restriction does not allow heavy aircraft operations on the south runway complex. The operational restrictions due to the Sepulveda tunnel are extensive. Peak hour heavy activity creates substantial delay due to the inability to use the South complex for "heavies" (aircraft weighing in excess of 300,000 lbs.). Excessive taxi distances (up to 2 miles in some instances) and departure cross over conflicts also contribute substantially to dalay.
- Environmental constraints that: 1) restrict the use of Runway 24R, and; 2) during the hours of midnight to 6:30 a.m., requires the airport to operate in an opposing east/west flow over water for noise abatement purposes.
- Only one runway (24R) is capable of operating arrivals and departures during periods when meteorological conditions fall below CAT I ILS minimums.
- The north parallel taxiway system serves both to provide for flow between terminals 2 and 3 and for Runway 24L departure queuing.
- Inadequate length on Runway 6L/24R tends to restrict heavy jet departures to Runway 24L even when conditions warrant outboard runway departures.
- The lack of aircraft holding aprons, for inbound aircraft awaiting gates and outbound aircraft awaiting clearance, exacerbates delays caused by the runway restrictions outlined above.

These system constraints increase delays due to the inability to use all runways equally. The Task Force determined that total annual aircraft delay at Los Angeles International Airport exceeded 37,000 hours in 1978 at an excess energy consumption cost of $32 million for aircraft operators.

Exhibit 3-1
Airfield Capacity

Runway Configuration		IFR Category (or Better)	IFR Controllers[1]/Visual Approach	VFR Basic[2]	VFR VAPS[3]
		114	114	114	114
		114	114	114	114
		104	104	104	104
	(Independent)	93	93	93	93
	(Dependent)	57	57	57	57
		47	47	47	47
	(Over-Ocean)	32	32	32	32

▷—Arrival
▶—Departure

[1]*Controller's Visual Approach*—IFR weather category denoted conditions when controllers can see aircraft and apply visual separation.

[2]*Basic VFR*—Weather is 1000/3 or better but minima not met for visual approaches.

[3]*VAPS*—Visual Approaches—Weather minima met for visual approaches.

NOTE: For each LAX configuration the EPS is the same for all weather categories. This is because LAX operates under strict metering procedures and IFR separation minimums in all categories of weather. Noise abatement regulations require increased separation during VFR weather equal to the IFR separation.

4.0 Analysis of Recommended Improvements

The Task Force members identified 9 near-term improvements which would reduce delay at Los Angeles International Airport. The proposed improvements were packaged into the near-term improvements most likely to be implemented in the 1982 and 1987 time frames. In addition, analyses were done to determine the best sequence of runway closure for the proposed Sepulveda Tunnel construction activity.

A brief description of the proposed improvements and estimates of their potential annual savings are shown in Exhibit 4-1. The following paragraphs describe, in detail, the effects of individual improvements, tunnel construction activities, and operating procedures on various airport performance characteristics.

4.1 Sepulveda Tunnel Improvements

The potential benefits of strengthening the tunnel under Runways 25R and 25L were estimated by studying the proposed near-term improvement package.

Some of the benefits expected after completion of the tunnel construction are:

- At the discretion of the ground controller, some heavy departures will be directed to the south runway complex based on their gate location, direction of flight after departure, etc.
- Delay reduction for departures by increasing ground traffic control flexibility.
- Improvement in nighttime operations through the revision of over-ocean restrictions. Some heavy aircraft departures on the north runway complex cross the south runway arrival route and interrupt the arrival stream. After tunnel construction, these departures may be redirected to the south runways, thus permitting an uninterrupted sequence of arrivals to either the north or south runways during departure operations.

Reconstruction of the Sepulveda Tunnel will require that each of the south complex runways (Runways 25/7) be closed during construction. As part of the overall effort, the Task Force analyzed the best sequence of construction and found that:

1. Construction should begin with Runway 25R (keeping 25L open) and then proceed to Runway 25L (and re-opening Runway 25R). This sequence of construction minimizes delays due to the Sepulveda Tunnel Reconstruction.

2. Reductions in both arrival and departure delays can be achieved during tunnel construction by utilizing Runway 24R (arrivals) and Runway 24L (departures) to their capacity. This would require a temporary relaxation of the existing noise abatement restrictions and runway use program.

4.2 High Speed Taxiway Exit Off Runway 25L

This improvement provided an additional path off Runway 25L at a position which would facilitate the movement of aircraft going to the cargo or general aviation areas located south of Runway 25L. The improvement would have a beneficial effect on reducing controller activity in handling some aircraft on the ground. In addition, any future expansion of facilities or increase in aircraft traffic in the south ramp area would require this exit to minimize the number of aircraft crossing over the two south runways.

4.3 Taxiway Access to Runway 24R Threshold and Temporary Holding Area in Proximity of Future Taxiway 75

(Annual Savings: $1,750,000 in 1982)
The proposed by-pass of Runway 24L (i.e., taxiway access to Runway 24R for departures) and a temporary holding area for arrivals were considered by the Task Force. The first improvement was intended to provide an uninterrupted departure queue for Runway 24R. This would avoid potential blockage by heavy aircraft waiting for departure on Runway 24L and permit departures to cross Runway 24L with ease. The second improvement was designed to provide a holding area for international and other carriers which did not have a gate available at the time of arrival.

Comparison of the eight-hour period of operation with and without the improvements

indicated a 7% reduction in total departure travel time and a 10% reduction in total departure delay.

4.4 Dual Taxiway

The dual taxiway improvement applies to the junctions of Taxiways J and K and Taxiways 45 and 49. It is intended to relieve the congestion which occurs in that area for arrivals entering Terminals 4 and 5 from the north complex. The new taxiway system will (at a minimum) preserve the present routing flexibility of the ground controller in separating the departure and arrival flow in that critical area after construction of the new west end terminal.

4.5 Remote Parking Positions for 24 Aircraft

Aircraft demand is expected to increase in the immediate future generating a higher demand for gates, particularly for international carriers who have recently shown a substantial growth rate at LAX. The establishment of a remote parking area for 24 wide-bodied jets in the vicinity of the future Taxiway 74 at the west end is needed to meet the projected international carrier peaking and overnight parking demand. This area will be serviced by buses to the terminals.

Phase 1 of this project, which began in October 1980, will provide six aircraft positions to relieve the immediate gate demand during the construction of the new terminals (Terminal 1 and West Terminal).

4.6 By-Pass on the North Side of Runway 7L, and High Speed Exits Off Runway 6R and 7L.

(Annual Savings: $193,000 in 1982)
The westerly flow of traffic is predominant at the airport, but there are times when over -ocean arrival operations (easterly flow) are required during certain wind conditions and at night.

Three proposed improvements to the runways are designed to provide an uninterrupted flow of arrivals and departures. The by-pass of Runway 7L will permit departures to queue up for Runway 7R and depart expeditiously during normal traffic flow. The high speed exits will facilitate the movement of arrivals off the runways and onto the taxiway at locations where they can be conveniently directed to their gates.

The by-pass around Runway 7L to 7R will result in the same improvement in performance as the proposed by-pass around Runway 24L to 24R, assuming similar traffic loads. This improvement, combined with the high speed exits, will bring the performance of the easterly traffic flow up to that of the westerly traffic flow.

4.7 Terminal Expansion (Terminal 1 and West End Terminal)

(Annual Savings $7,000,000 in 1982)
New terminals have been planned to accommodate the increase in the passenger demand expected in the immediate future. A benefit of the new terminals is an opportunity to balance the aircraft traffic between the north and south runway complexes, based on the desirability of landing and departing an aircraft on a runway closest to its gate. This requires relaxation of the current runway use constraints.

4.8 Wake Vortex Alleviation and/or Detection

(Annual Savings: $3,700,000 in 1982)
Major changes are expected to occur in the technology available to Air Traffic Control that would increase the capacity at Los Angeles International Airport (as well as other airports). These improvements would provide for closer spacing of aircraft on final approach (either through vortex alleviation or detection techniques) and for a more uniform sequencing of aircraft (metering and spacing).

The Task Force strongly recommends that all promising Research/Development endeavors to alleviate or detect wake vortices be accelerated. Reduced separation between arriving aircraft has the potential of achieving considerable savings in aircraft delay.

5.0 AirTraffic Demand and Delay Relationships

This section summarizes the results of the simulation experiments which demonstrated the current and future relationships between air traffic demand and aircraft delay, and

identified the delay reduction benefits of near-term (1982) and far-term (1987) improvements in airport facilities, ATC equipment, and ATC procedures.

The operation of the existing airfield and the potential benefits of the improvements were assessed in terms of airfield capacity, airfield demand, and average aircraft delays. Estimates of average aircraft delays are based on the values—and the interrelationships—of airfield capacity and demand. Knowing the estimated average aircraft delay permits assessment of both the operational feasibility of the airfield and the potential economic benefits of the improvements.

Various airfield system improvements, ranging from changes in air traffic control procedures to changes in physical facilities and operations, can increase airfield capacity and thus reduce delays. If a dollar value is attached to each minute of average aircraft delay, the cost of a particular airfield improvement can be weighed against its annual delay savings. For a given forecast increase in demand, a suitable combination of airfield improvements can be implemented in stages so that airfield capacity is increased as needed and average aircraft delays are maintained within acceptable limits.

Exhibit 4-1

Estimates of Potential Annual Savings From Improvement Packages (**) or Improvements (*)

IMPROVEMENT	POTENTIAL ANNUAL SAVINGS (1982)
****Near-Term Improvements**	**$16.8 million**
* High speed taxiway off R25L	
* Strengthening Sepulveda Tunnel	
* Taxiway Access to R24R	($1.75 million)
* High Speed Exit off R7L	
* High Speed Exit off R6R	($193 thousand)
* By-Pass Area for R7L	
****Terminal Expansion**	**$7.0 million**
****Wake Vortex Alleviation**	**$3.7 million**

5.1 Air Traffic Demand

Actual and forecasted air traffic demands were prepared for the 1978, 1982 and 1987 time periods. Additional 1982 and 1987 aircraft schedules were prepared in total daily increases of 5% and 15% over the projected 1982 and 1987 operations. Each air traffic demand applied to an experiment required a specified arrival and departure runway distribution and individual gate assignments by airlines.

While the forecast of traffic for Los Angeles was prepared in 1978, it is still consistent with the latest Terminal Area Forecasts published by the FAA in February 1981. Actual 1980 aircraft operations at Los Angeles were 523,961, well above the 1982 projection used in this study of 518,157. While the growth of air traffic activity has slowed, the projections for 1982 and 1987 demand levels at Los Angeles International Airport used for this study are not inflated. There are indications that the projected 1982 demand level +5%, as used in this study effort, may realistically occur in 1982.

The actual (1978) and projected (1982, 1987) demand schedules were used to calculate the estimated annual demand and passenger enplanements for Los Angeles International Airport. The basic assumption in the calculation was that the demand represented an average day over a two-month period, July and August, which comprised about 19% of the total traffic and 25% of the passenger enplanements.

Exhibits 5-1 through 5-3 illustrate the projected airfield demand levels used during the study.

5.2 Summary of Airfield Delay Studies

Airfield delay is the additional travel time, caused by airfield congestion, taken by an aircraft to move from point A to point B. Computing average annual airfield delays involves:

- Airfield physical characteristics
- Air traffic control procedures
- Aircraft operational characteristics
- Airfield demand
- Weather

Average annual delays are expressed in minutes per aircraft operation.

Aircraft operating delays occur at LAX as a result of the interaction between current demand levels and the existing airfield layout and operating restrictions. The following are the primary causes of delay:

a. Restricted use of Runway 24R for landings due to noise abatement and preferential runway use program.

b. Aircraft weight restrictions on the south runway complex due to the Sepulveda Boulevard overpass.

c. Intra-hourly aircraft volume and arrival/departure ratio peaking.

Several performance measurements were calculated from the experimental computer runs to indicate the changes which occur as improvements are introduced into both the air traffic control and airport design scenarios. These measures include the peak average delays, the annual delay estimates, the total delays and the travel time during a simulated time period. They were calculated under different estimates of air traffic demand and operating conditions.

Exhibit 5-4 is a summary of annual delay estimates for the various demands, the ATC system scenarios and the airport facilities improvements. The plotted results shown in Exhibit 5-5 illustrate past, present and possible future operating conditions at LAX. Projected points on the curves were calculated using the percentages of improvement in delay reduction attributed to the near-term or far-term conditions of both the ATC scenario and the airport design.

Exhibit 5-4 illustrates several important conclusions.

a. Based upon the 1987 demand (which assumes a change in aircraft mix) and the 1987 ATC separations, the additional 1987 airport improvements reduce annual delays dramatically—by 45%.

b. Based upon the 1987 demand and the 1987 airport improvements, the 1987 separations reduce annual delays by 41%.

c. Based upon the 1982 demand and the 1982 ATC separations, the additional 1982 improvements reduce annual delays by 38%.

d. Based upon the 1982 demand and the 1982 improvements, the 1982 ATC separations reduce annual delays by 13%.

e. The delays produced by the 1982 + 5% and the 1982 + 15% demands are significantly greater than the delays produced by the 1987 demands.

Exhibit 5-5 vividly illustrates that according to actual 1979 annual operations, LAX is on the knee of the demand vs. delay curve, and unless the proposed improvements are implemented, aircraft delay will drastically increase.

Exhibit 5-1 Airfield Demand Levels

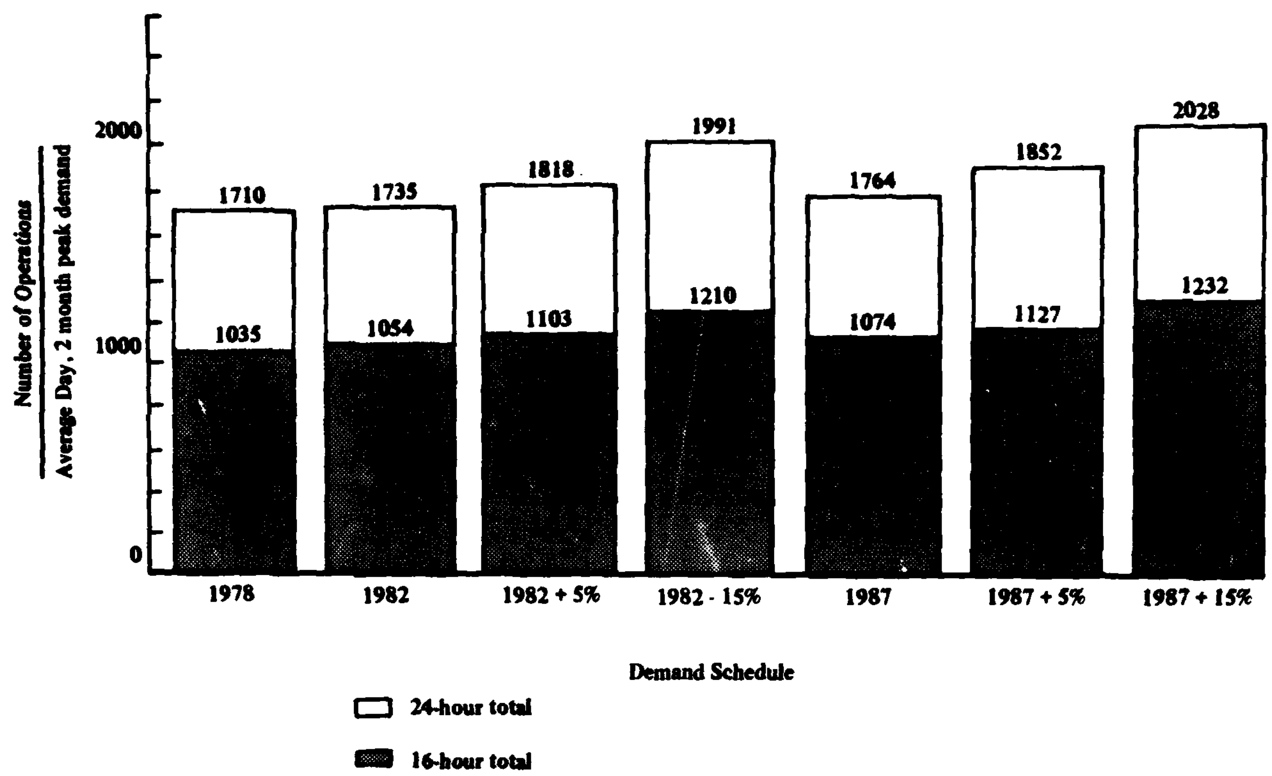


Exhibit 5-2 Aircraft Operations

	No. of Operations			Class Distribution*			
	Annual	Avg. Day	Peak Hour	Class 1	Class 2	Class 3	Class 4
1978	510,263	1,710	111	21.5%	55.4%	17.9%	5.2%
1982	518,157	1,735	114	23.9%	55.0%	15.9%	5.2%
1982 + 5%	544,368	1,818	120	23.9%	55.3%	15.9%	4.9%
1982 + 15%	599,000	1,991	131	23.9%	55.6%	15.9%	4.6%
1987	527,315	1,764	115	27.0%	54.0%	13.9%	5.1%
1987 + 5%	553,680	1,852	122	26.9%	54.1%	13.9%	5.1%
1987 + 15%	606,411	2,028	132	27.0%	54.0%	13.9%	5.1%

*Class 1—Heavy—greater than 300,000 lbs.
Class 2—Large—12,500 lbs. to 300,000 lbs.
Class 3—Small—twin engine less than 12,500 lbs, and Lear jets
Class 4—Smaller—single engine less than 12,500 lbs.

Exhibit 5-3 Hourly Variation of 1978 Demand

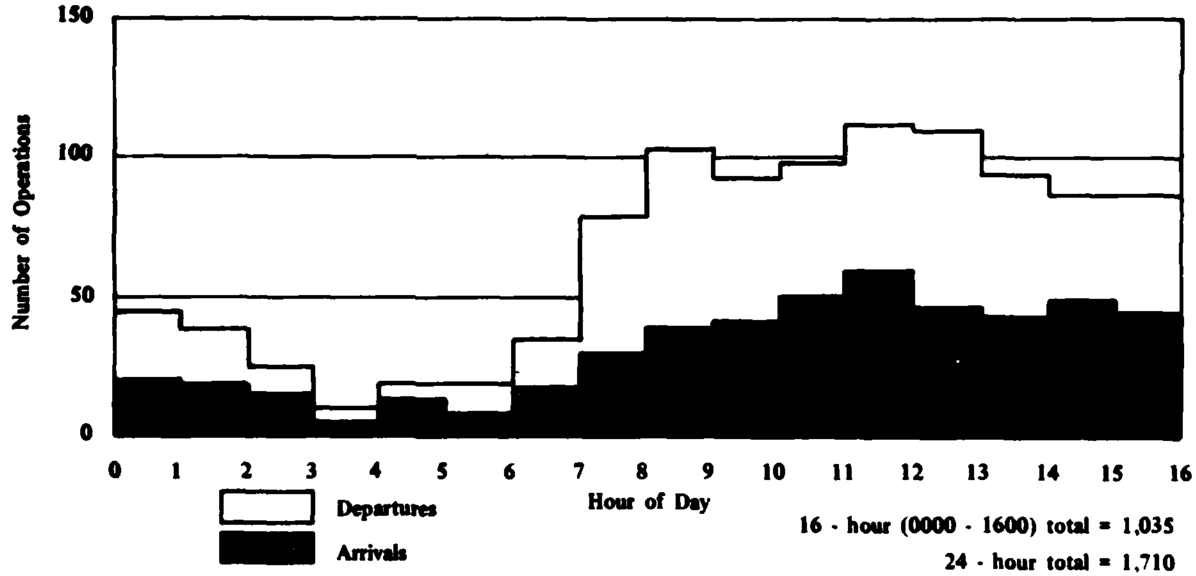


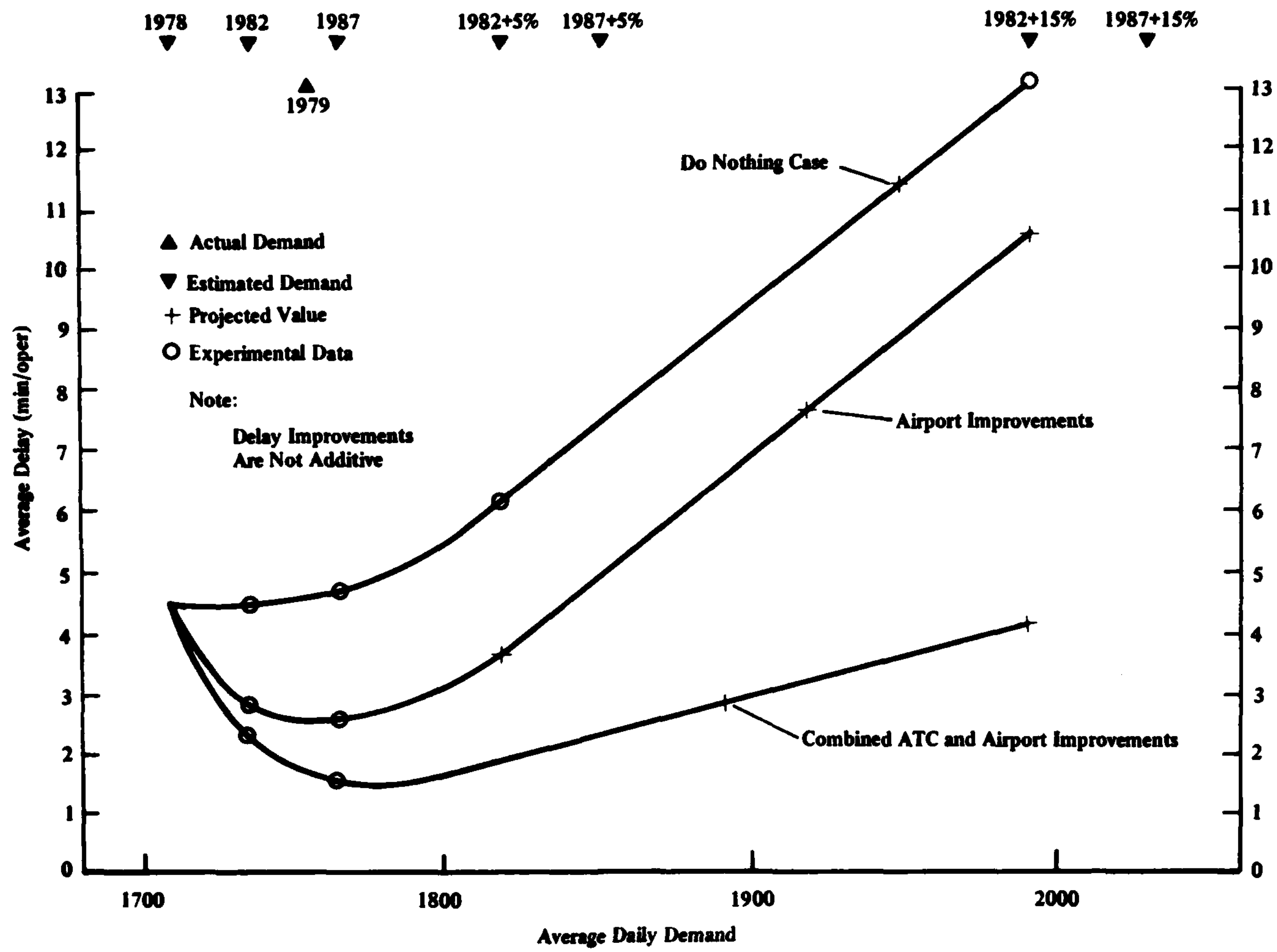
Exhibit 5-4 Summary of Estimated Delays

EXPERIMENT NO.	DEMAND	ATC SYSTEM SCENARIO	AIRPORT IMPROVEMENTS	ANNUAL DELAY (HOURS)	AVERAGE DELAY (MIN/OPER)
17	1978	1978	none	37,991	4.5
30	1982	1978	none	39,630	4.6
30A	1982 + 5%	1978	none	56,289	6.2
30B	1982 + 15%	1978	none	130,382	13.1
28	1982	1982	none	33,953	3.9
29	1982	1978	1982	24,113	2.8
27	1982	1982	1982	21,037	2.4
34	1987	1978	none	41,334	4.7
33	1987	1978	1987	22,908	2.6
32	1987	1987	none	24,354	2.8
31	1987	1987	1987	13,496	1.5
43	1987 + 5%	1982	1987	30,147	3.3
44	1987 + 15%	1982	1987	53,858	5.3
	*1982 + 5%	1978	1987	31,292	3.6
	*1982 + 5%	1987	1987	17,970	2.0
	*1982 + 15%	1987	1987	41,624	4.2

NOTE: Percentage decrease in delay is not additive.

*Projected Values

Exhibit 5-5 Estimated Average Delay (1978—1987)



6.0 Recommendations

Most of the airfield improvements proposed in this study are identified in the Los Angeles International Airport Capital Improvement Program. Proposed projects will require a program of follow-up and implementation by both the Department of Airports and the Federal Aviation Administration to further determine the merit of the following recommendations.

Near Term

— High-speed taxiway of Runway 25L to the south.

— Strengthening of the Sepulveda Tunnel.

— Departure by-pass taxiway around Runway 24L to Runway 24R.

— Aircraft holding aprons.

— Parking for 24 aircraft at the west end of the airport.

— Terminal expansion including Terminal 1 and the West Terminal.

— High-speed taxiway off Runway 7L to the north.

— High-speed taxiway off Runway 6R to Taxiway 47.

— Departure by-pass taxiway around Runway 7L to Runway 7R.

Far Term (Over 2 years)

— Construct Taxiway 75 between Runway 6R/24L and Runway 7L/25R and extend Taxiway J west to connect with Taxiway 75.

— Construct holding areas in the most strategic locations available to benefit arriving and departing aircraft.

— Accelerate Research and Development activities associated with wake vortex alleviation and/or detection in order to implement procedures to reduce arrival sequence spacing.

The following suggested airport improvements were not evaluated by the group using the FAA Capacity Model. Nonetheless, in the Task Force's judgment, these improvements would contribute to reducing aircraft delay and should be considered as potential improvement projects.

— Install a second Category III ILS on Runway 25L.

— Extend Runway 6L/24R 1360 feet and construct connecting Taxiway 75V.

— Extend Taxiway 36V between Runway 24L and 24R.

In 1982, the estimated benefit of the airfield improvement exceeds $20 million. The incremental benefit of wake vortex alleviation or detection and the subsequent reduced separation standards exceeds $3.7 million annually.

Exhibit 6-1 Action Plan

Improvement	FAA	Airlines	City
Near Term			
—High-speed taxiway off Runway 25L			X
—Strengthen Sepulveda Tunnel			X
—By-pass taxiway to Runway 24R			X
—Temporary holding area			X
—Parking for 24 aircraft			X
—Terminal expansion			X
—High-speed taxiway off Runway 7L			X
—High-speed taxiway off Runway 6R			X
—By-pass taxiway to Runway 7R			X
Far Term			
—Extend Runway 6L/24R 1360 feet			X
—Extend Taxiway 36V			X
—Construct Taxiway 75			X
—Extend Taxiway J			X
—Construct holding area			X
—Install CAT III on Runway 25L	X		
—Wake VORTEX Alleviation/Detection	X		

This document and the Task Force Delay Study VOL. II, which contains supporting documentation for the detailed airport analysis, are available to the public. Copies may be obtained through the:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

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